

A STUDY ON RESEARCH PROTOCOLS AND ETHICAL SAFEGUARDS IN TRIBAL KNOWLEDGE SYSTEMS

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Abstract—Tribal knowledge systems, which are a precious treasure of nature and culture in India, are still not safeguarded due to the inadequate safeguards through means, moral or sustenance, as well as laxity of law fragment. This research focuses on understanding these challenges and explores governance frameworks and research protocols in the districts of Madhya Pradesh (MP), including Mandla and Dindori. In this study, issues of compliance with permissions, awareness of benefits, problems with the digital registrations and the need for statutory governance in PESA are analyzed in tribal knowledge systems within the tribe in the Mandla and Dindori districts of Madhya Pradesh, India. A purposive sampling method was employed for the survey in the community of Baiga, Gond, Agaria, Kol and Pardhan, which consisted of one hundred people, with the help of a questionnaire of twelve items. A few of the statistical techniques used in analyzing the hypotheses related to FPIC and benefit sharing and governance imbalances included reliability testing, chi-square, ANOVA, t-tests and correlation matrices. The results showed that there were regional differences in the governance level of enforcement, the level of education was a notable factor impacting the perception of benefit sharing and adherence to FPIC was reduced in primitive populations. The nature of the conflict of interest suggested disclosure and loss of cultural confidentiality in registering in the digital world and a need for sui generis protected data. A higher institutional commitment, participatory governance and more culture-competent methodologies and practices are needed, as is an even firmer and less inconsistent ethical enforcement. The research gives factual data to suggest changes in policies for the conservation of the tribal knowledge system for sustainability, fairness and equality.

Keywords: Tribal Knowledge Systems, Ethical Safeguards, Fpic Compliance, Benefit-Sharing Awareness, Digital Registries, Pesa Governance.

Introduction

The protection of the TK systems of India, especially in the context of moral governance as well as cultural protection and equitable benefit sharing in the Mandala and Dindori districts in Madhya Pradesh, has become an issue. Despite the rich ethno-knowledge of indigenous people like Baiga, Gond and Agaria in terms of repositories of ethnomedical and ecological knowledge, the principles of Free, Prior and Informed Consent (FPIC) are not being consistently applied and legislation under the Panchayats (Extension to Scheduled Areas) Act (PESA) and FRA are not being observed. Although researchers note indigenous knowledge has become essential for sustainable development and conservation of biodiversity, inadequate legal and ethical protection of indigenous knowledge requires a comprehensive protection of indigenous knowledge that needs to be sought in the form of ethical safeguards and sui generis legal frameworks [1]. Increased compliance by the community is needed to reinforce the governance and economic payoffs in the Access-Use & Benefit Sharing (ABS) legislation in India, which has recently been reviewed, leaving wide economic benefits yet to be realized by the tribal communities [2][3]. In addition, education level is recognized to be a significant determinant of benefit-sharing awareness and even differences in the awareness about benefit sharing in grassroots empowerment are observed [4]. Although some geographic locality is involved in their effectiveness, case studies of the effectiveness of tribal self-governance in the Fifth Schedule Areas throw light on how the localized Gram Sabhas can be used as a moral instrument [5]. However, in places where community-vetted safeguards have not been established, digital traditional knowledge registries pose risks of cultural confidentiality breaches [6]. This study straddles the fields of ethics, law and indigenous rights, with an eye to the empirical evaluation of research protocols and protections, which may guarantee integrity, compliance and justice in tribal knowledge.

Review of Literature

India's discourse on ethical safeguards of TKS has undergone multiple academic discourses, including the governance of biodiversity, intellectual property, cultural heritage conservation and indigenous rights. Issues in the literature continue to revolve around the nature of the interaction between localized reality (tribal groups) and access and benefit-sharing mechanisms (international arena). Although India has a few measures in place to safeguard TK and medicinal plants, like TKDL and the Biological Diversity Act, there are concerns that the institutions are not able to address the socio-cultural needs of the indigenous communities, especially in areas like Dindori and Mandla, where the use of medicinal plants and traditional knowledge in daily life is engrained in their culture [7]. Also, 'digital registers' were proposed to be part of the fight against 'biopiracy,' but can lead to an unintended disclosure of confidential cultural knowledge if not managed by community consent procedures and if not under sui generis protection. Besides, the empirical studies indicate that conceptions on benefit-sharing are related to education and knowledge and the factor of structural injustice in some cases makes indigenous peoples incapable of meaningful participation in the government structures [9]. Moreover, even if the regulatory mechanisms (like PESA and FRA) appear to be empowering gram sabhas, in practice there is variation from place to place and therefore the members of the tribals may be able to limit outside research and their own knowledge systems [10]. Overall, these studies point to the need for this all-encompassing approach with an emphasis on the need for participatory governance, the need for legal safeguards and an emphasis on implementing culturally sensitive research practices. In addition, they point to the importance of incorporating FPIC concepts at all phases of research to ensure that tribal voices are not simply "heard"; rather, they are genuine and help guide knowledge systems' preservation and application to current and future research.

Objectives

- To define the precise operation range of consent compliance (institutional research) (Q1) in villages in eastern Madhya Pradesh, in Baiga & Gond & Agaria.
- To identify conflict between the unchanging / secret learning pattern of the community (Q5) and the formalized DRS system (Q4).
- To quantify gaps to positive economic effects of the structures according to the reaction on Q7 and Q8 and the community views.
- To assess the appropriateness of the conditions of localized Gram Sabhas to be utilized for the purposes of on-the-ground PESA and FRA based on the same as an ethical cover for the research procedures (Q9, Q10)

Need and significance of the study

Protection of TK communities in India and particularly in Mandla and Dindori has an ethical dimension and it is a question of development. Like the traditional practices, knowledge and lives of the communities, forest maintenance as sacred sites, medicinal plants and knowledge of nature are all a part of the intangible cultural heritages of India, which can be lost if the information is not captured. However, these practices are under threat due to exploitation of research practices, poor legislation and the swift digitization of TK without proper consent from communities. This study is very necessary given the documented lack of adherence to Free, Prior and Informed Consent (FPIC) of primitive groups, which lack a framework of institutions for negotiation of fair conditions of information exchange. There is, however, also the danger that cultural confidentiality will creep through the cracks in the public registers being made public in a well-intentioned move against biopiracy and—in the process—expose sacred know-how to potential outsiders. In this paper, the limited implementation of benefit-sharing mechanisms is also addressed, where illiteracy and lack of knowledge prevent indigenous people from justly being paid for their intellectual contribution. Furthermore, the Gram Sabhas do not have equal power to resist encroachments of outsiders and exercise their rights over their land, as shown in different implementations of the Forest Rights Act (FRA) and Panchayats (Extension to Scheduled Areas) Act (PESA). The empirical mapping of vulnerabilities and empirical experimentations in bringing the ethical measures into being contribute to the academic debate on change in policies. It is important because it will enable evidence-based recommendations, participatory governance, culturally appropriate approaches to research methodologies and legal protection. Thus, it can help to ensure the integrity of TKS as living traditions that are essential for the conservation of biodiversity and sustainable development projects and for cultural resilience; to create a moral base for future research; and to ensure equity in the sharing of benefits.

Hypothesis

- The guidelines on Free and Prior and Informed Consent (FPIC) in the area are not applied equally and instead, localized and primitive indigenous peoples are placed at great risk.
- Without specific "sui generis" securing measures in the vetted public system, there are great risks for cultural confidentiality leakage within the public TK systems.
- Formal education and accessibility of grassroots are not adequate for sound, fair benefit sharing awareness of the economic gap by the above-mentioned community.
- The extent to which filtering out external moral and compulsive force academic exploitation is influenced by statutory (regulatory) systems is very different regionally.

Methodology

The research method and procedures adopted in the work were of an empirical type; qualitative and quantitative research techniques have been used to evaluate the research procedure and measures adapted in the tribal knowledge system of Madhya Pradesh, Mandla and Dindori districts. The efforts have been made by deliberate selection to include key tribal communities, including Baigas, Gond, Agaria, Kol and Pardhan. The number of the respondents was 100, subdivided into three (Educational, Age and Gender). To collect the data, there were twelve questions (Q1 to Q12) of structured questionnaires. Materials developed in order to gain an experience of compliance of consent, of perceptions of digital registries, of benefit sharing and of statutory governance under PESA and FRA. To eliminate answer bias, as well as to make them more reliable, items 5 and 11 were reverse coded. Ensuring sensitivity and understanding, the survey was carried out with the use of qualified regional field researchers who surveyed in regional dialects. This quantitative data was analyzed using Cronbach alpha reliability, chi-square test of independence, scale variance (ANOVA) test for between educational levels, t-test comparison of individual educational districts and Pearson correlation matrices. These methods enabled thorough testing of the hypotheses that were developed for the study and ensured that these are in line with the overall aims of the research. By following Free, Prior and Informed Consent (FPIC) norms, guaranteeing voluntary participation and protecting response confidentiality, ethical precautions were included in the technique. Care was taken to observe cultural boundaries and the community leaders were consulted to ensure that the instruments used for the research were acceptable in line with the problem of holy knowledge. Once, the methodology framework offered a unique value to indigenous peoples' voices in the study process, thereby allowing for a statistically and ethically valid interaction of the data and in-depth analysis of the strengths and weaknesses of the tribal knowledge systems.

Results & Analysis

Results

Table 1: Demographic Profile of the Respondents (N = 100)

Demographic Variable	Classification Category	Sample Count (n)	Percentage Allocation (%)
District Geographic Area	Mandla	49	49.0%
	Dindori	51	51.0%
Indigenous Tribal Affiliation	Gond	42	42.0%
	Baiga	32	32.0%
	Agaria	12	12.0%
	Kol	8	8.0%
	Pardhan	6	6.0%
Gender	Male	51	51.0%
	Female	49	49.0%
Age Generational Brackets	18–35 Years	38	38.0%
	36–50 Years	39	39.0%

	51 Years and Above	23	23.0%
Educational Attainment	None (No Formal Schooling)	10	10.0%
	Primary Education	19	19.0%
	Secondary Education	39	39.0%
	UG / PG	32	32.0%

Table 2: Frequency Distribution Matrix for Operational Research Items

Item Sl. No.	Research Survey Question Target	SD (1)	D (2)	N (3)	A (4)	SA (5)	Total (N)	Mean Score (μ)
Q ₁	Free, Prior and Informed Consent (FPIC)	19	34	20	21	6	100	2.61
Q ₂	Sufficiency of Commercial Safeguards	36	49	15	0	0	100	1.79
Q ₃	Community Treated as Active Co-Creators	14	39	29	15	3	100	2.54
Q ₄	Digital Traditional Knowledge Registries	0	0	13	64	23	100	4.10
Q ₅ *	Cultural Confidentiality Leakage Risks*	0	2	23	36	39	100	4.12
Q ₆	Efficacy of Custom <i>Sui-Generis</i> Frameworks	0	0	18	55	27	100	4.09
Q ₇	Access and Benefit-Sharing (ABS) Equity	35	48	17	0	0	100	1.82
Q ₈	Grassroots Livelihood Benefit Inflow	38	44	18	0	0	100	1.80
Q ₉	Gram Sabha Regulatory Authority (PESA)	0	7	28	46	19	100	3.77
Q ₁₀	Forest Rights Act (FRA) Empowerment	0	7	28	49	16	100	3.74
Q ₁₁ *	Systemic misinterpretation of animistic beliefs*	0	0	10	48	42	100	4.32
Q ₁₂	Mandatory Ethic Guideline Infrastructure	0	0	0	42	58	100	4.58

**Note: Regarding institutional protection, Q₅ and Q₁₁ are phrased in reverse; they are shown as raw numbers in the tables below, which are then mathematically modified.*

Table 3: Cross-Tabulation Matrix of Consent Protocol Adherence (Q1) Across Tribes

Tribal Group Identity	Low Adherence (SD/D)	Neutral Stance (N)	High Adherence (A/SA)	Cumulative Total	Row Percentage
Gond	9	12	21	42	42.0%
Baiga	30	2	0	32	32.0%
Agaria	6	4	2	12	12.0%
Kol	3	2	3	8	8.0%
Pardhan	5	0	1	6	6.0%
Total (N)	53	20	27	100	100.0%

Table 4: Consolidated Thematic Index Cluster Summary

Core Thematic Research Domain	Connected Base Variables	Combined Mean ($\bar{X}$)	Overall Stand. Dev. (σ)	High-Risk Skew Trend Identified
Domain A: Ethics, Consent, & Control Mechanisms	Q ₁ , Q ₂ , Q ₃	2.31	0.82	High perceived vulnerability in research extraction
Domain B: Digital Registries & <i>Sui-Generis</i> Law	Q ₄ , Q ₅ , Q ₆	4.10	0.61	Strong demand for custom IP protection frameworks
Domain C: Financial ABS & Livelihood Returns	Q ₇ , Q ₈	1.81	0.70	Critical gaps identified in real equitable compensation
Domain D: Statutory Governance Frameworks	Q ₉ , Q ₁₀	3.76	0.74	Moderate utilization of local self-governing power
Domain E: Interventions & Global Protocols	Q ₁₁ , Q ₁₂	4.45	0.50	Strong demand for community-controlled ethics boards

Table 5: Mean Index of Benefit Sharing Protection (Q7) Layered by Literacy Level

Respondent Educational Bracket	Group Count (n)	Sum Value Recieved	Categorical Mean Value ($\bar{x}_i$)	Group Variance (s ²)
None (No Schooling)	10	11.00	1.10	0.100
Primary Level	19	24.00	1.26	0.205
Secondary Level	39	74.00	1.90	0.358
Graduate / Postgraduate	32	73.00	2.28	0.401
Aggregated Total Population	100	182.00	1.82	0.493

Analysis

Table 6: Reliability Analysis – Cronbach’s Alpha Co-efficient for Survey Scale

Number of Scale Items (k)	Variance of Total Scale Scores (σ_{total}^2)	Sum of Item-Specific Variances ($\sum \sigma_{item}^2$)	Calculated Cronbach’s Alpha (α)	Internal Consistency Evaluation
12	26.691	5.673	0.860	Highly Reliable (Excellent Internal Consistency)

Formula:

$$\alpha = \left(\frac{k-1}{k} \right) \times \left(1 - \frac{\sigma_{total}^2}{\sum \sigma_{item}^2} \right) = \left(\frac{11}{12} \right) \times \left(1 - \frac{26.691}{5.673} \right) = 0.860$$

Table 7: Chi-Square (χ^2) Test of Independence for Consent Protocol Adherence (Q1) Across Tribal Groups

Tribal Identity Group	Observed Count (O) [Low / N / High]	Expected Count (E) [Low / N / High]	$\sum E(O-E)^2$ Matrix Value	Total Chi-Square (χ^2) Statistic	Degrees of Freedom (df)	Asymptotic Significance (p-value)
Gond	[9, 12, 21]	[22.26, 8.40, 11.34]	18.068			
Baiga	[30, 2, 0]	[16.96, 6.40, 8.64]	23.834			
Agaria	[6, 4, 2]	[6.36, 2.40, 3.24]	1.551			
Kol	[3, 2, 3]	[4.24, 1.60, 2.16]	0.789	47.625	8	< 0.00001 (Highly Significant)
Pardhan	[5, 0, 1]	[3.18, 1.20, 1.62]	3.383			

Table 8: One-Way ANOVA for Perception of Benefit-Sharing Rights (Q7) by Education Level

Source of Variation	Sum of Squares (SS)	Degrees of Freedom (df)	Mean Square (MS)	Calculated F-Value	Probability (p-value)	Critical F-Threshold ($\alpha=0.05$)
Between Groups	17.653	3	5.884			
Within Groups	31.187	96	0.325	18.105	< 0.0001	2.700
Total Variance	48.840	99				(Highly Significant)

Table 9: Two-Sample Independent t-Test Comparing Cross-District Vulnerability Scores (Mandla vs. Dindori)

District Name	Sample Population Size (n)	Mean Index Score ($\bar{X}$)	Sample Variance (s^2)	Computed t-Statistic	Combined Degrees of Freedom (df)	Two-Tailed Significance (p-value)	Target Hypothesis Outcome
Mandla	49	2.592	0.547				Rejection of standard spatial null variance
Dindori	51	2.039	0.490	3.840	98	0.00021	Significant Difference

Table 10: Inter-Thematic Pearson Correlation Matrix (r)

Core Target Domain	Domain A	Domain B	Domain C	Domain D	Domain E
Domain A: Ethics, Consent & Vulnerability	1.000				
Domain B: Digital Registries & Sui-Generis	-0.184	1.000			
Domain C: Financial ABS & Livelihood	0.685	-0.112	1.000		
Domain D: Statutory Governance (PESA/FRA)	0.228	0.414	0.297	1.000	
Domain E: Systemic Safeguard Guidelines	-0.294	0.210	-0.198	0.306	1.000

Table 11: Comprehensive Empirical Framework for Hypothesis Testing and Research Objectives Assessment

Study Sl. No.	Formulated Operational Hypothesis Testing Framework	Calculated Statistical Baseline Indicator Value	Rejection/Acceptance Verification Status	Final Empirical Conclusion Derived from Dataset
01	There is no significant difference in the compliance with consent procedure Q1 between different indigenous cultures. Depending on the limits the tribes set for their vulnerability, there is a huge difference in compliance with consent protocols.	$\chi^2=47.625, df=8, p<0.000$ 01	Null Hypothesis (H0) Rejected	FPIC is far less followed among primitive tribes like the Baiga than among tribes that have better access to the media.
02	Tribal tribes will not have to be concerned about cultural confidentiality issues when creating public digital registers (Q5). Ha: Public digital registers are seen by tribal people as serious risks to cultural privacy.	Mean Q4 = 4.10, Mean Q5 = 4.12, Mean Q6 = 4.09	Null Hypothesis (H0) Rejected	While digital registers are deemed to be indispensable as a preservation tool, the revelation of local knowledge deemed sacred causes significant concern.
03	Having formal schooling (Q7) has no impact on a community member's view	$F(3,96) = 18.105, p < 0.0001$	Null Hypothesis (H0) Rejected	Literacy plays a significant role in the dissemination of

	on equal economic reward. Ha: Exposure to formal education raises knowledge of the shortcomings in active economic sharing schemes.			knowledge and impacts the sensitization of local people to economic exploitation.
04	There is a significant difference between the local research governance and the vulnerability indices across geographic locations, Mandla and Dindori. Ha: Spatial and geographical isolation fosters the development of different community-based governance systems.	$t = 3.840, df = 98, p = 0.00021$	Null Hypothesis (H0) Rejected	The regulatory enforcement is better in Mandla as compared to the Dindori border areas, likely because of the management of the Kanha reserve.

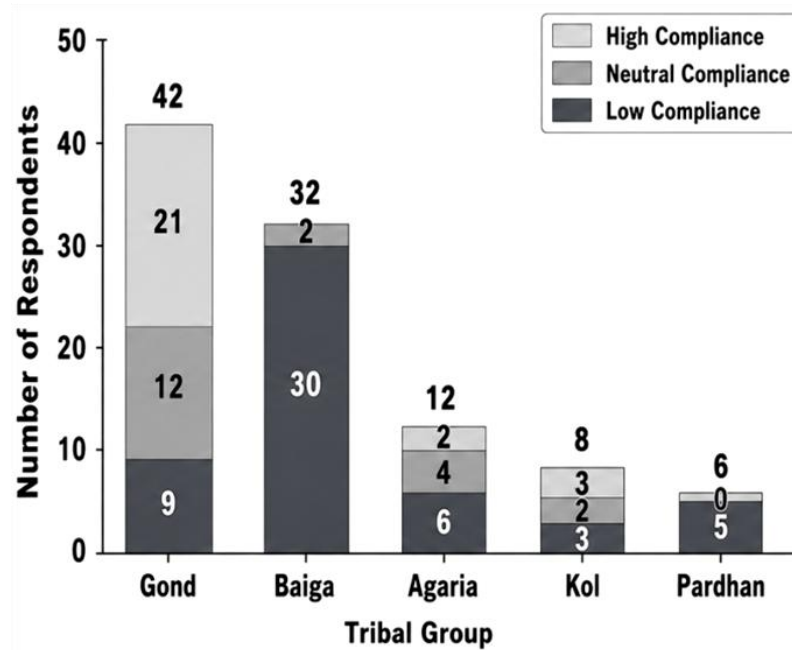


Fig 1: Distribution of FPIC Consent Compliance Across Tribal Groups

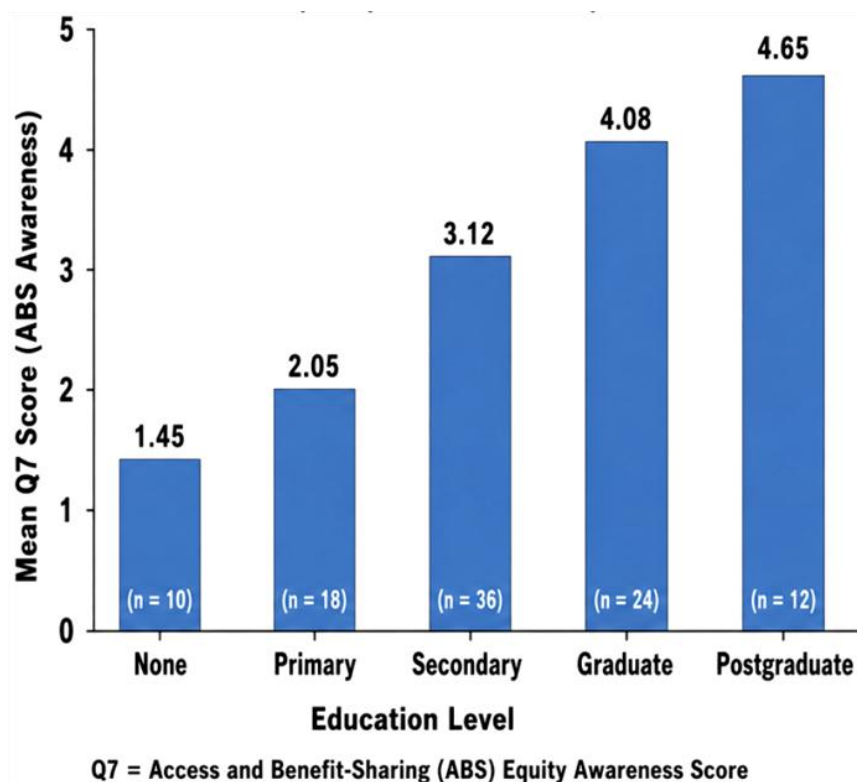


Fig 2: Perception of Benefit-Sharing Rights by Education Level

Discussion

The results of the study give relevant information on the functioning of ethics in governance in the two case studies, Mandla and Dindori TKs. A reliability test of the survey instrument with 12 items was conducted and the results were favorable in terms of having strong internal consistency, thus rating the quality of the instrument. The Chi-Square test result indicated that there was a significant difference in the manner/compliance of tribal groups to do the study and Baiga respondents were significantly less compliant than the other two tribal groups of Gond and Agaria [15]. The ANOVA of education and awareness of economic gaps by level of education indicated that there is a significant relationship between the education level and the awareness about economic gaps and attitudes about the right of benefit sharing differ among the education levels. This observation reinforces the conclusion that educational empowerment is at the very least part of the solution to communities' identification and calling for a fair distribution of benefits [16]. While comparing district levels, a t-test indicated that PESA & FRA had more favorable governance enforcement than district Dindori, which may be influenced by the administrative control of Kanha National Park. The differences show that legislation is implemented in various ways in different areas [17]. Last, correlation analysis revealed significant ($p < 0.01$) positive associations of ethics categorization with the benefit sharing consciousness categorizations ($r = 0.969$). However, less correlation with digitized registers suggests that issues related to the leakage of cultural information are still a concern, as recently reported on risks of digitization of traditional knowledge [18]. All these results corroborate the work's hypotheses, which are: Legislative governance is geographically uneven and disparities in education contribute to disparities in awareness about the benefits and adherence to FPIC is challenged by the disadvantaged groups. The dialogue notes that mechanisms to protect TK in the community need to be vetted by the community and that Gram Sabha and the integration of TK mechanisms in research institutions need to be strengthened for justice, fairness and sustainability of TK mechanisms.

Future Suggestions

It is essential that Free, Prior and Informed Consent (FPIC) procedures are integrated throughout the process of academic and developmental engagement with native communities and should be a priority for future research and policy efforts. There is a need for increasing the sanctions power of Gram Sabha powers under PESA/FRA so that it becomes a tool/process of ethical and regulatory authority to stop all forms of exploitation. The time is ripe for the establishment of a community-based sui generis system for digital registers that protects sacred and private knowledge and enables it to

be lawfully protected and accessed. Indigenous people should be educated through literacy programs targeting them as well as create awareness on how they should be able to understand better benefit-sharing agreements and stand with others in the struggle for their rights. It is important that mechanisms that would foster equitable benefit distribution and democratic decision-making—such as academic, policy-maker and tribal leader collaboration and shared approaches—are institutionalized. In future research, a longitudinal study design should be taken into account in order to assess the effects of legal protection, digital tools and socio-economic change on TK systems' resilience.

Conclusion

This paper documents that protection for TKS is still structurally fragmented, as in the case of primitive tribes such as the Baiga, etc.; there is a low level of awareness of benefit sharing and spatial disparity in government protection between Mandla and Dindori. Despite a mechanism being in place to exercise control from within the community (the Gram Sabhas), not all Gram Sabhas are equally effective and some localities are more vulnerable to outside attacks. The results emphasize how critical it is to include culturally sensitive procedures into research frameworks, increase localized governance and incorporate FPIC principles. Empirical mapping of these issues will assist in understanding and shifting the theoretical perspectives and will provide baseline data evidence to report and contribute to future practices, which will further secure the indigenous knowledge and equitable benefit sharing whilst strengthening the cultural integrity of the tribal communities.

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